MAYO CLINIC
Mayo Medical Laboratories

Staffing to Workload to Process Specimens Delivered Daily by a Boeing 757: How We Met Turnaround Times While Resolving the Long Tail of Late Samples

presented by: John Butz, M.B.A.

The Three Shields

Collaborating to Help Patients

Mayo Clinic's Primary Value

The needs of the patient come first

Mayo Clinic's Mission

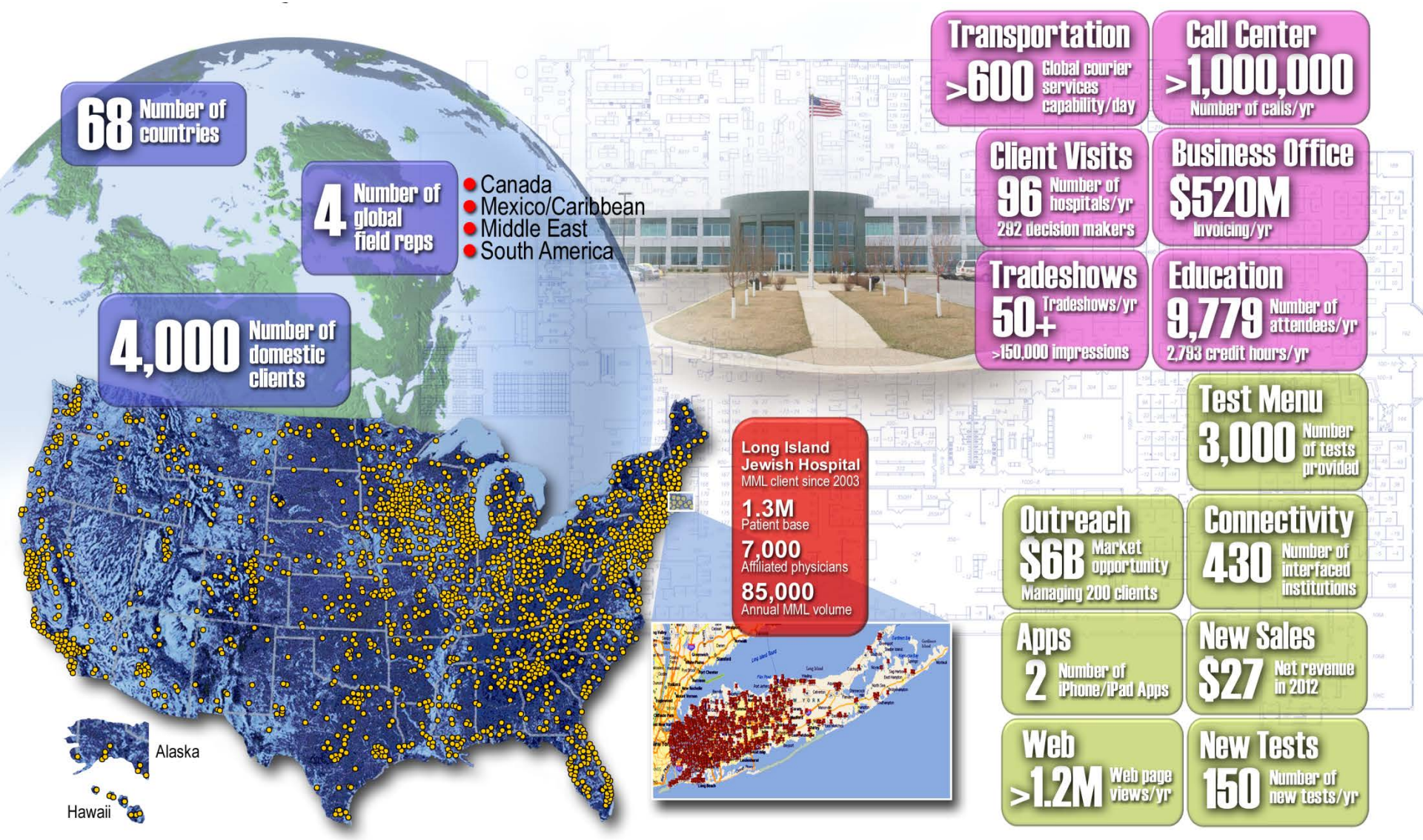
To inspire hope and contribute to health and well-being by providing the best care to every patient through integrated clinical practice, education, and research

DLMP's Mission

To provide the highest quality laboratory and pathology services to the patients, physicians, and others we serve

Overview of MML

- Established 1971
- Fully integrated part of Mayo Clinic
- Department of Laboratory Medicine and Pathology
- Daily receipt of ~33,000 specimens per day



MML Preanalytic Process

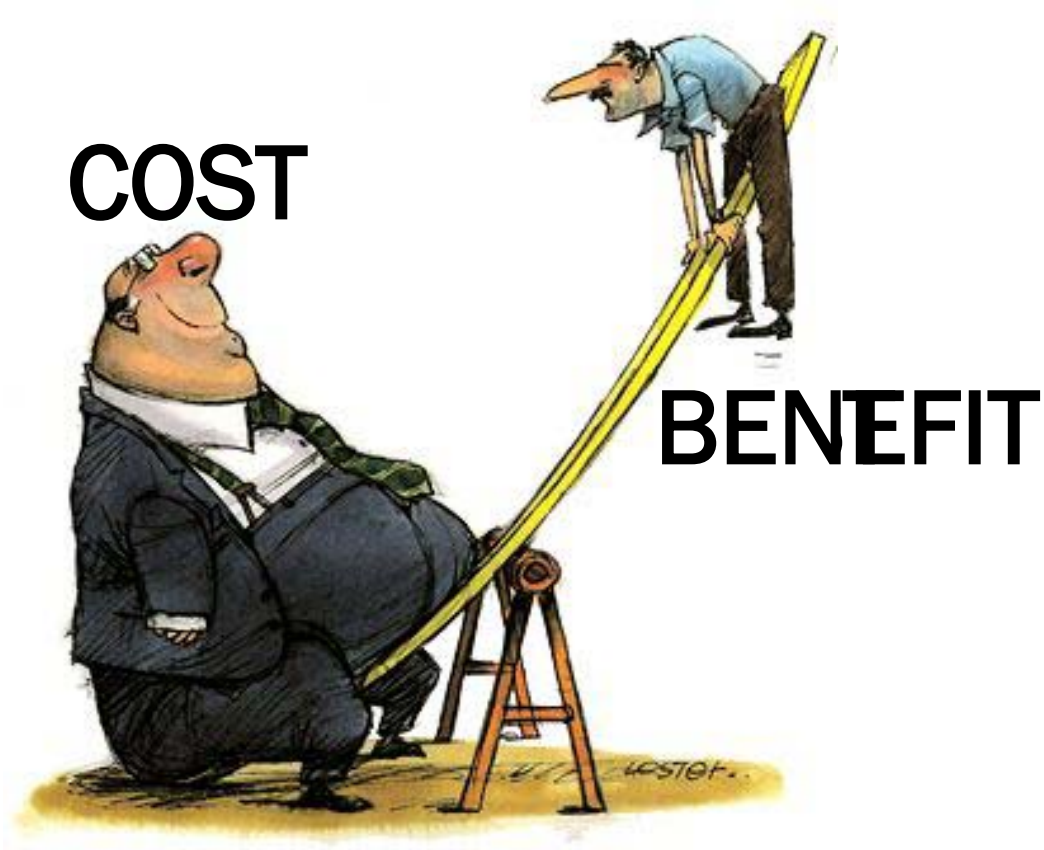
- Transportation and logistics
- Internal Operations and Accessioning
- Specimen Distribution
  - Sorting and delivery

- http://news.mayomedicallaboratories.com/beyond-the-berry-box/
- **Operations VIDEO**

Objective of Internal Operations

- Provide customer with test-ready specimens
  - Appropriately labeled
  - Received in the LIS
  - Appropriate specimen volume, container type, temperature
  - Within the timeframe to meet setup
- To post results as soon as reasonably possible within clinical decision-making expectations
  - Customer perspective is the one that counts

Image of Cost v. Benefit/Effectiveness



Internal: Maintain all specimen centric quality attributes

External: The fundamental measure of quality is Turnaround Time

QUALITY

TIME

COST

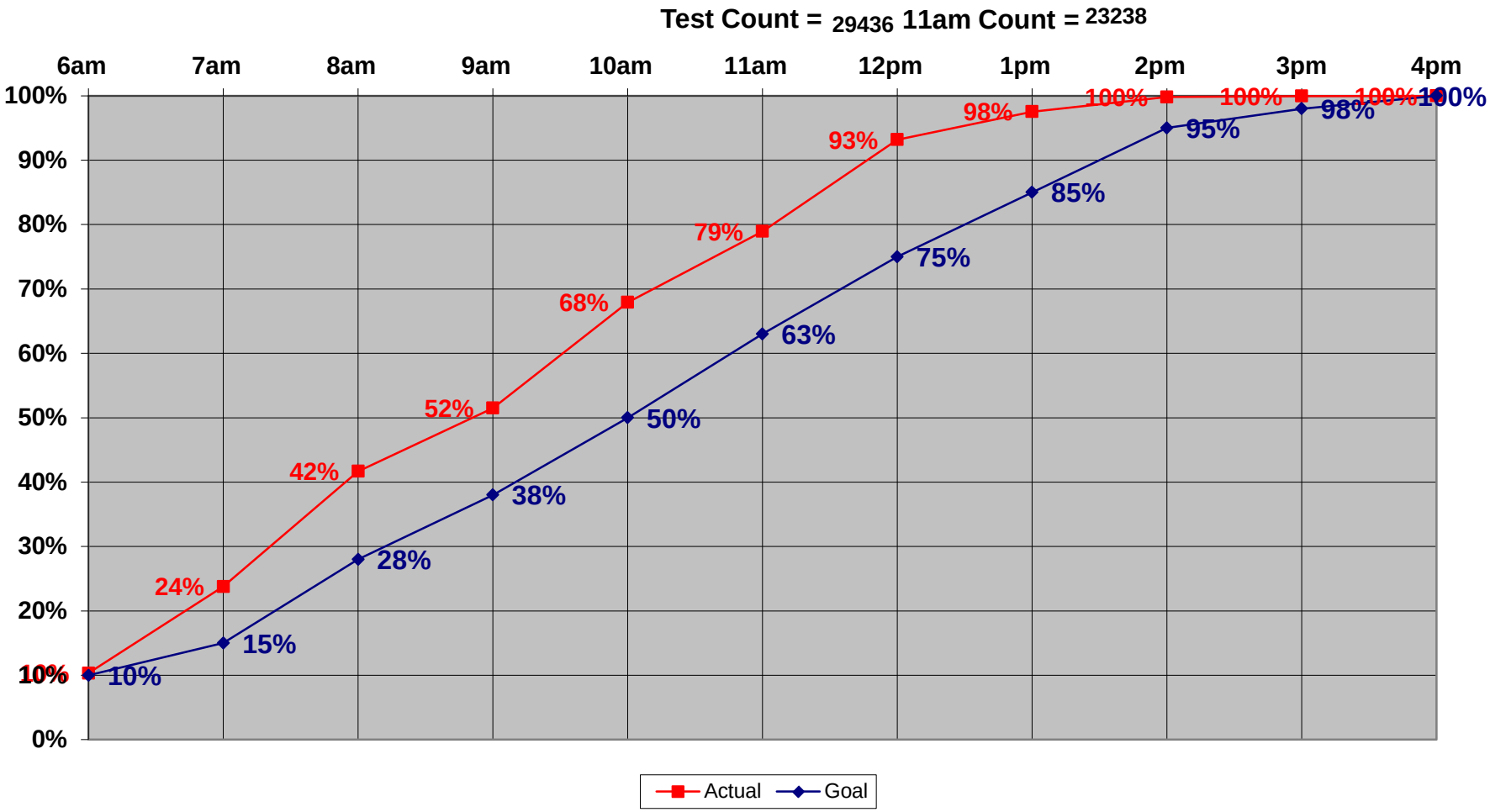
Primary Tool Set

- Lean
- Six Sigma
- Value Stream Mapping
- Histograms/Data Analysis
- “5 Whys”
- Change Management

Previous model

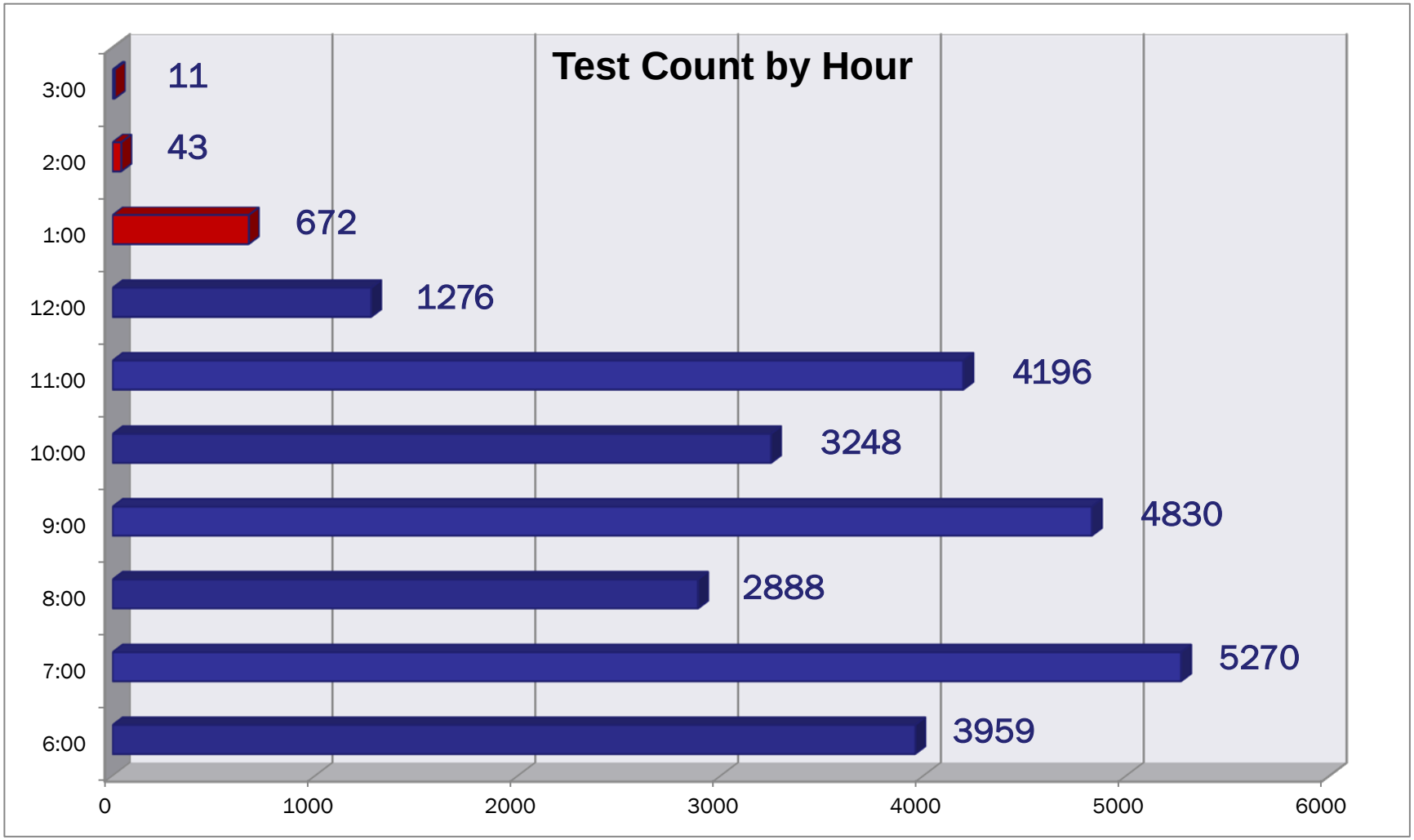
- High utilization of personnel
- Cost efficiency
- High process effectiveness
- Everything accessioned and to the lab by 2:00
  - Small % specimens arrived too late for lab cutoff
  - Next batch could be next day or several days
  - One minute or one hour late – same effect

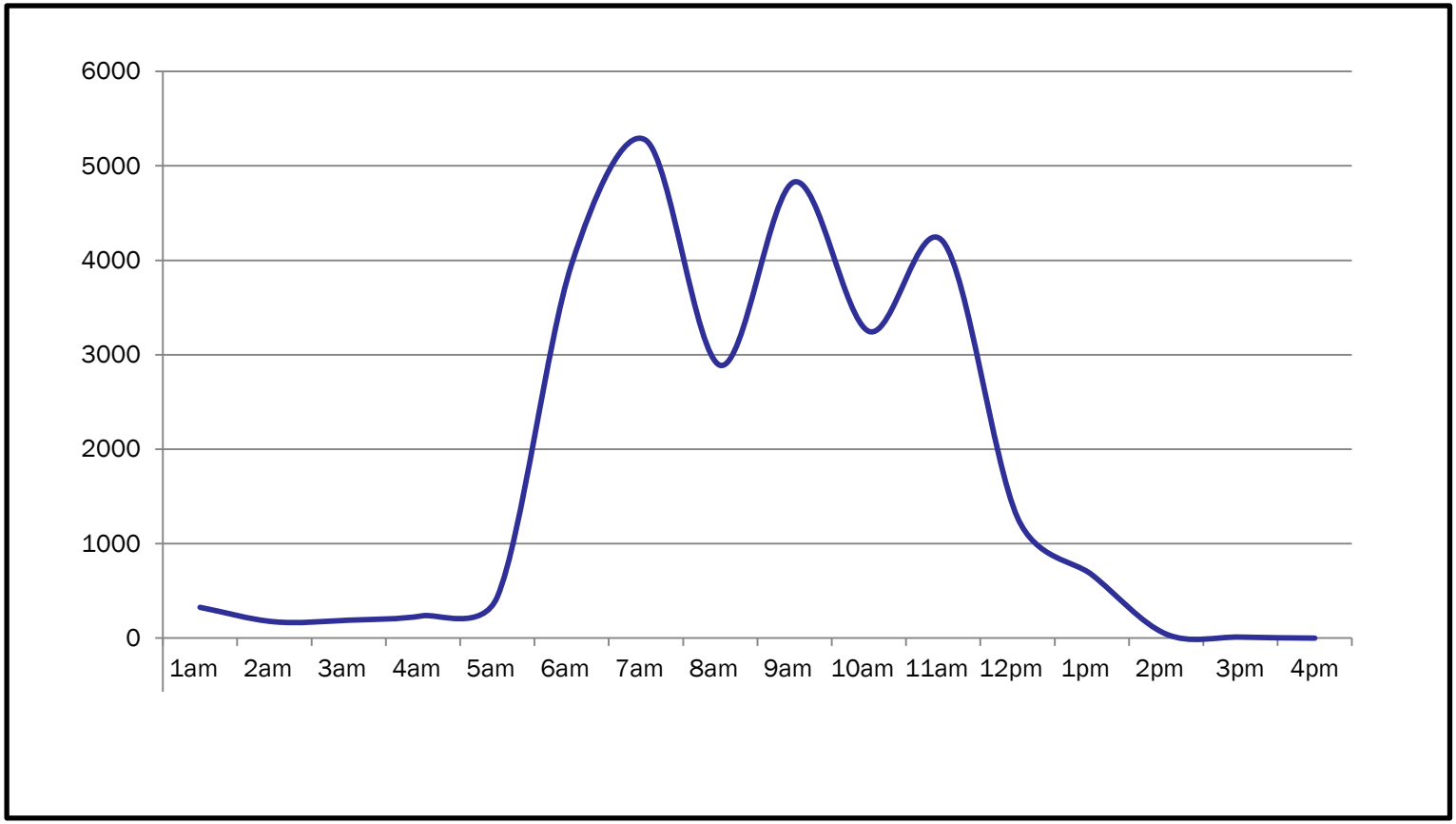
Process Results = Process Design



Hitting the Target, Missing the Bullseye

Tail Becomes a Problem





The workload is not the problem

VARIATION

VARIATION

VARIATION

How do you inventory SERVICE?

Ideal Process Flow

- Continuous flow of inputs and outputs
- Predictable workload
- Standard inputs
- Few defects
- Standardized processes and training
- No expediting

Preanalytic Batch Size: Boeing 757

FedEx video

Timing Variation

Workload Variation

Realties of Clinical Laboratory

- Incomplete orders
- Acceptable, but non-standard tube type
- Insufficient processing tubes
- Labels that won't scan
- 8 yards of parafilm on tube

Staffing Model

- 8 teams
- 24x7 coverage
- Start ~6:00 AM
- 68 employees to cover Tue-Sat
- Fulltime Employees
  - Easier to schedule
  - Fewest people to manage

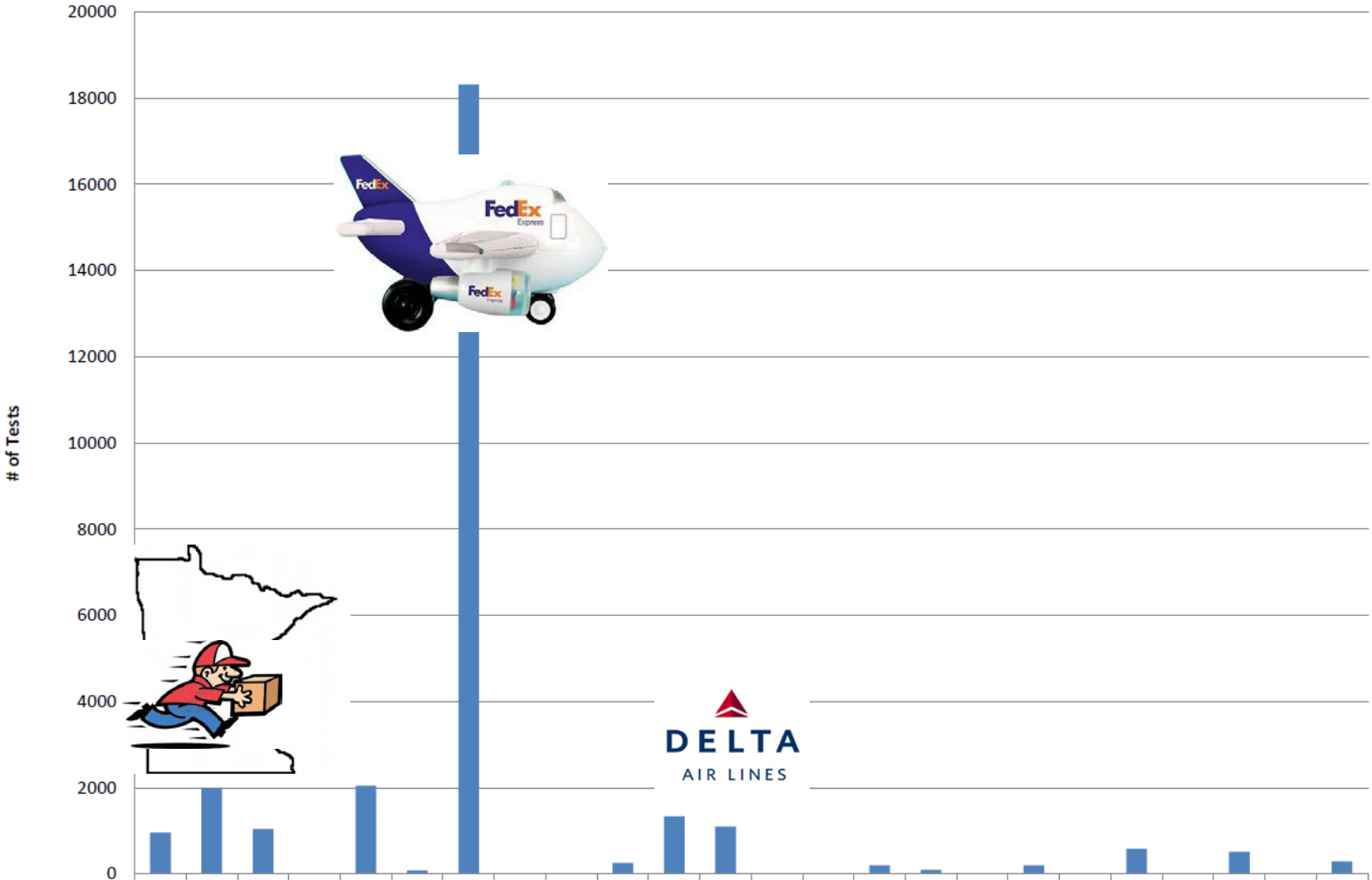
Solutions

- Hire more personnel
  - Lower personnel utilization
  - Very costly very quickly
  - How many people is enough?
- Hire more personnel – send them home when the work is done
  - Recruiting
  - Does not build loyalty and morale within workforce
  - It is not who we are as an employer

Systematic Changes

- What is the service level we need to provide?
- What is the appropriate resource need to provide it?
- How do I most effectively deploy that resource?

Tue-Fri Test Arrival Pattern (29,000 average)



	0:00 to 1:00	1:00 to 2:00	2:00 to 3:00	3:00 to 4:00	4:00 to 5:00	5:00 to 6:00	6:00 to 7:00	7:00 to 8:00	8:00 to 9:00	9:00 to 10:00	10:00 to 11:00	11:00 to 12:00	12:00 to 13:00	13:00 to 14:00	14:00 to 15:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	18:00 to 19:00	19:00 to 20:00	20:00 to 21:00	21:00 to 22:00	22:00 to 23:00	23:00 to 24:00
Tue-Fri Arrival	958	1991	1037	0	2045	79	18314	0	0	255	1330	1096	0	0	200	88	0	196	0	583	0	514	0	293

Summary – 5 AM Start Staffing Model

- Tests to get to the labs quickly
  - Late night and overnight in-handed by 7 AM
  - Processed and accessioned by noon
  - Remainder as it arrives
- Minimize floor space
- Minimize mislabels & lost specimens
- Maximize safety

Summary (continued)

- 6 Pods to handle high volume days (29,000 tests)
  - 12 stations for lab assistants
  - 1 station for a pod lead
  - ½ station for a triage lead
  - 6 pods = 81 stations
- A separate straining pod designed for 4 trainees

Summary (continued)

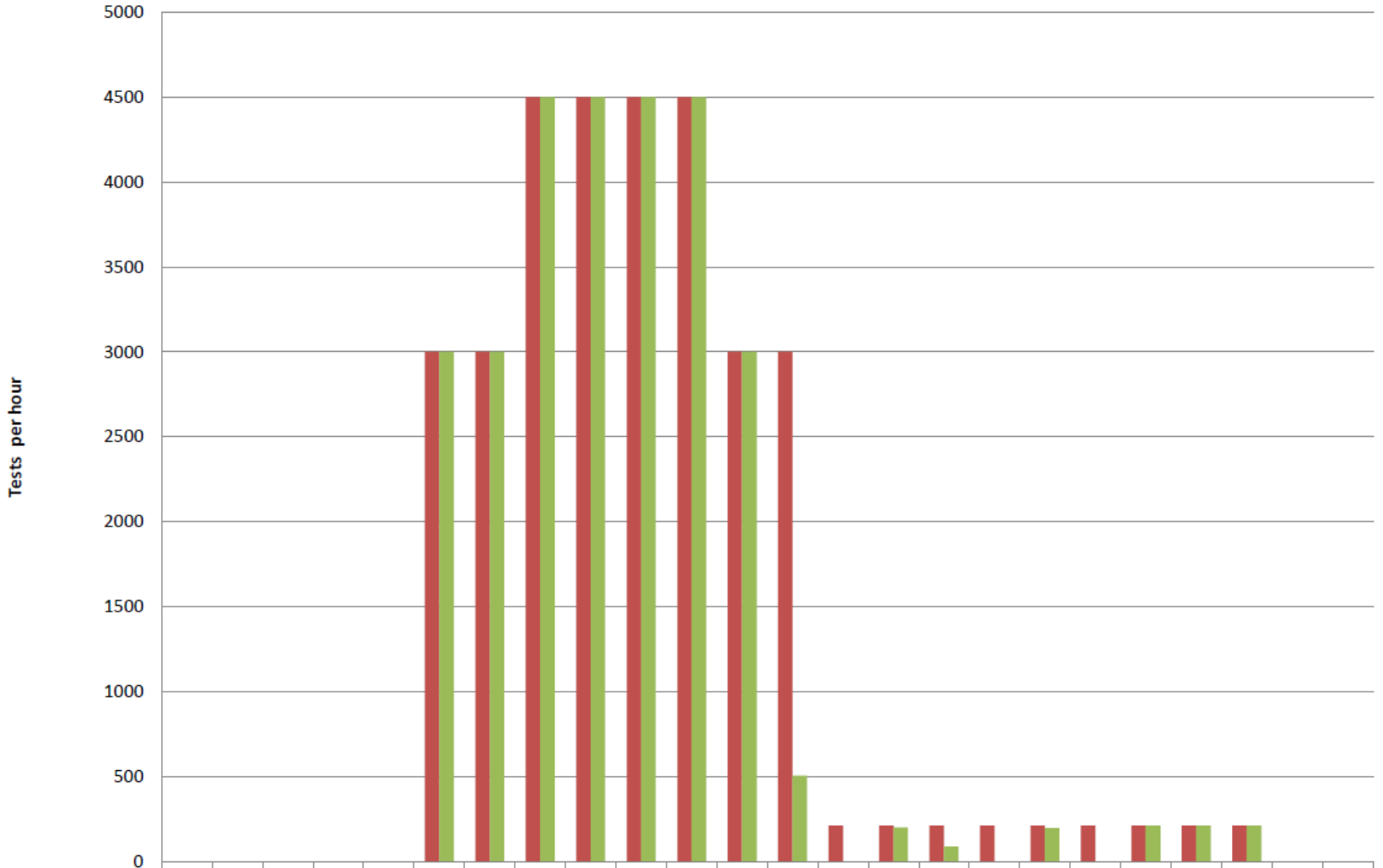
- Theoretical staffing plan for Lab Assistants
  - Staff hours: 456 hours (57 FTE)
  - Break/Lunch hours: 57 hours (7 FTE)
  - PTO/FMLA hours: 46 hours (6 FTE)
  - Sick Leave/Other: 23 hours (3 FTE)
  - Total FTE hours per day: 582 hours (73 FTE)

Tue-Fri Test Arrival Pattern (29,000 average)

DELTA
AIR LINES

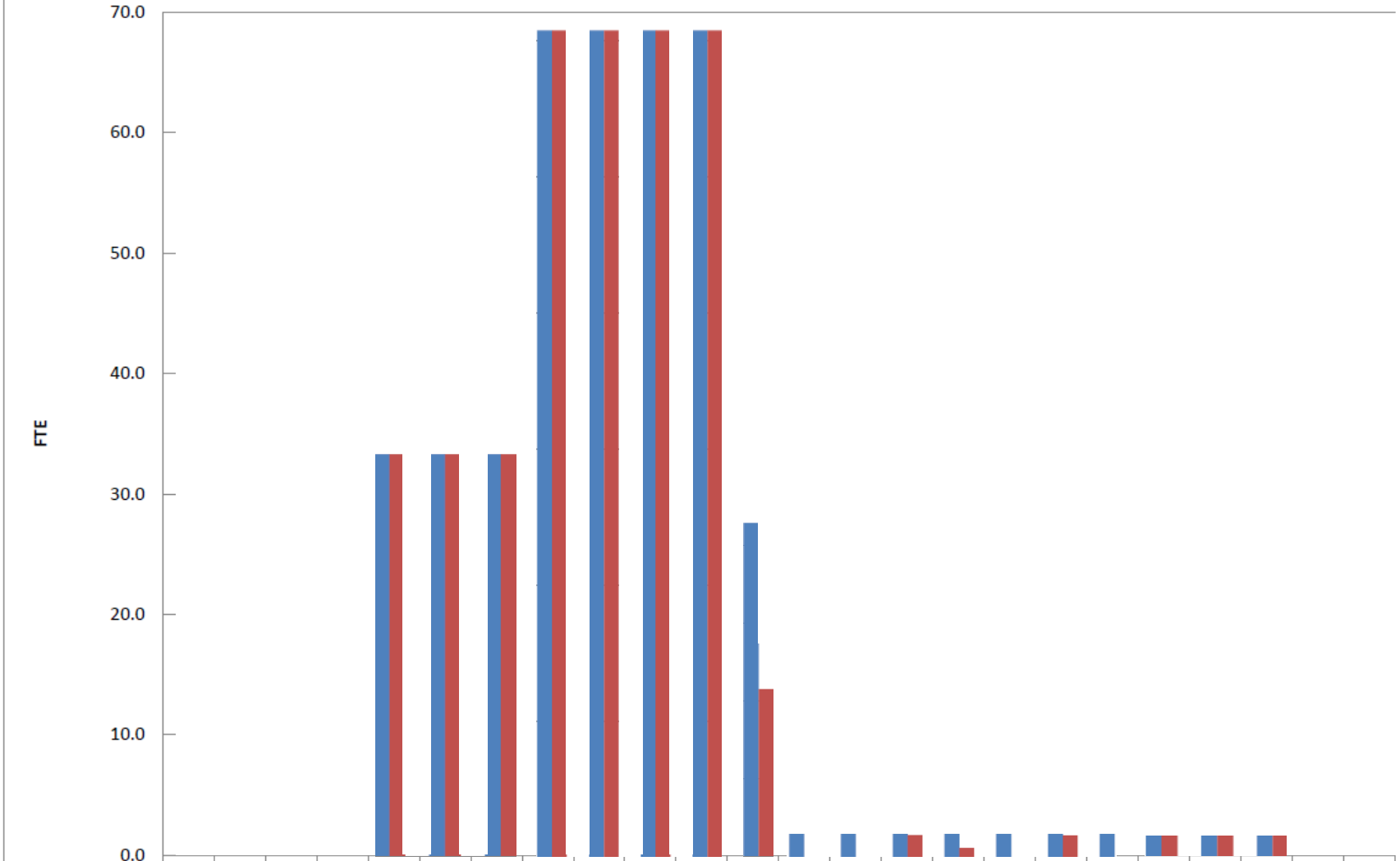
	0:00 to 1:00	1:00 to 2:00	2:00 to 3:00	3:00 to 4:00	4:00 to 5:00	5:00 to 6:00	6:00 to 7:00	7:00 to 8:00	8:00 to 9:00	9:00 to 10:00	10:00 to 11:00	11:00 to 12:00	12:00 to 13:00	13:00 to 14:00	14:00 to 15:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	18:00 to 19:00	19:00 to 20:00	20:00 to 21:00	21:00 to 22:00	22:00 to 23:00	23:00 to 24:00
Tue-Fri Arrival	958	1991	1037	0	2045	79	18314	0	0	255	1330	1096	0	0	200	88	0	196	0	583	0	514	0	293

Tue to Fri Accesioning Rate/Output



	0:00 to 1:00	1:00 to 2:00	2:00 to 3:00	3:00 to 4:00	4:00 to 5:00	5:00 to 6:00	6:00 to 7:00	7:00 to 8:00	8:00 to 9:00	9:00 to 10:00	10:00 to 11:00	11:00 to 12:00	12:00 to 13:00	13:00 to 14:00	14:00 to 15:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	18:00 to 19:00	19:00 to 20:00	20:00 to 21:00	21:00 to 22:00	22:00 to 23:00	23:00 to 24:00
Design Limit	0	0	0	0	0	3000	3000	4500	4500	4500	4500	3000	3000	210	210	210	210	210	210	210	210	210	0	0
Actual In-Handed	0	0	0	0	0	3000	3000	4500	4500	4500	4500	3000	505	0	200	88	0	196	0	210	210	210	0	0

Tue to Fri IO Accessioning Staff



	0:00 to 1:00	1:00 to 2:00	2:00 to 3:00	3:00 to 4:00	4:00 to 5:00	5:00 to 6:00	6:00 to 7:00	7:00 to 8:00	8:00 to 9:00	9:00 to 10:00	10:00 to 11:00	11:00 to 12:00	12:00 to 13:00	13:00 to 14:00	14:00 to 15:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	18:00 to 19:00	19:00 to 20:00	20:00 to 21:00	21:00 to 22:00	22:00 to 23:00	23:00 to 24:00
Staff @ Bench	0.0	0.0	0.0	0.0	0.0	42.9	42.9	64.3	64.3	64.3	64.3	42.9	42.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.0	0.0
Work	0.0	0.0	0.0	0.0	0.0	42.9	42.9	64.3	64.3	64.3	64.3	42.9	7.2	0.0	2.9	1.3	0.0	2.8	0.0	3.0	3.0	3.0	0.0	0.0

Model Considerations

- Benefits
  - Objective, data based FTE plan
  - High efficiency/safety capacity
  - Meets goal

- Detractions
  - Safety capacity too late in the day
  - Expense and difficult to absorb delays
  - Moves staff start time

Summary – 4 AM Start Staffing Model

- Tests to get to the labs quickly
  - Late night and overnight in-handed by 7 AM
  - Processed and accessioned by noon
  - Remainder as it arrives
- Minimize floor space
- Minimize mislabels & lost specimens
- Maximize safety

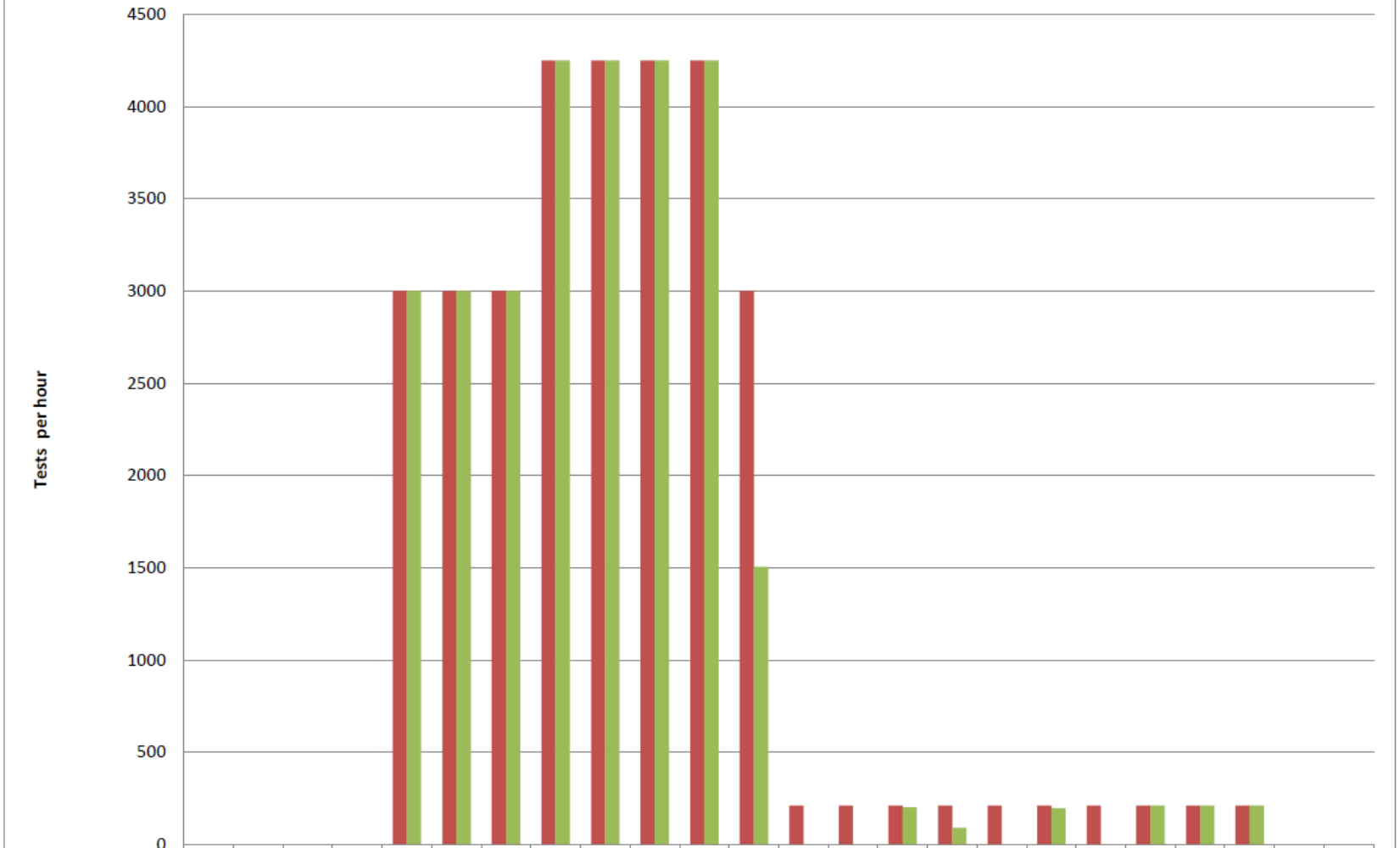
Summary (continued)

- 6 Pods to handle high volume days (29,000 tests)
  - 11 stations for lab assistants
  - 1 station for a pod lead
  - ½ station for a triage lead
  - 6 pods = 75 stations
- A separate training pod designed for 4 trainees

Summary (continued)

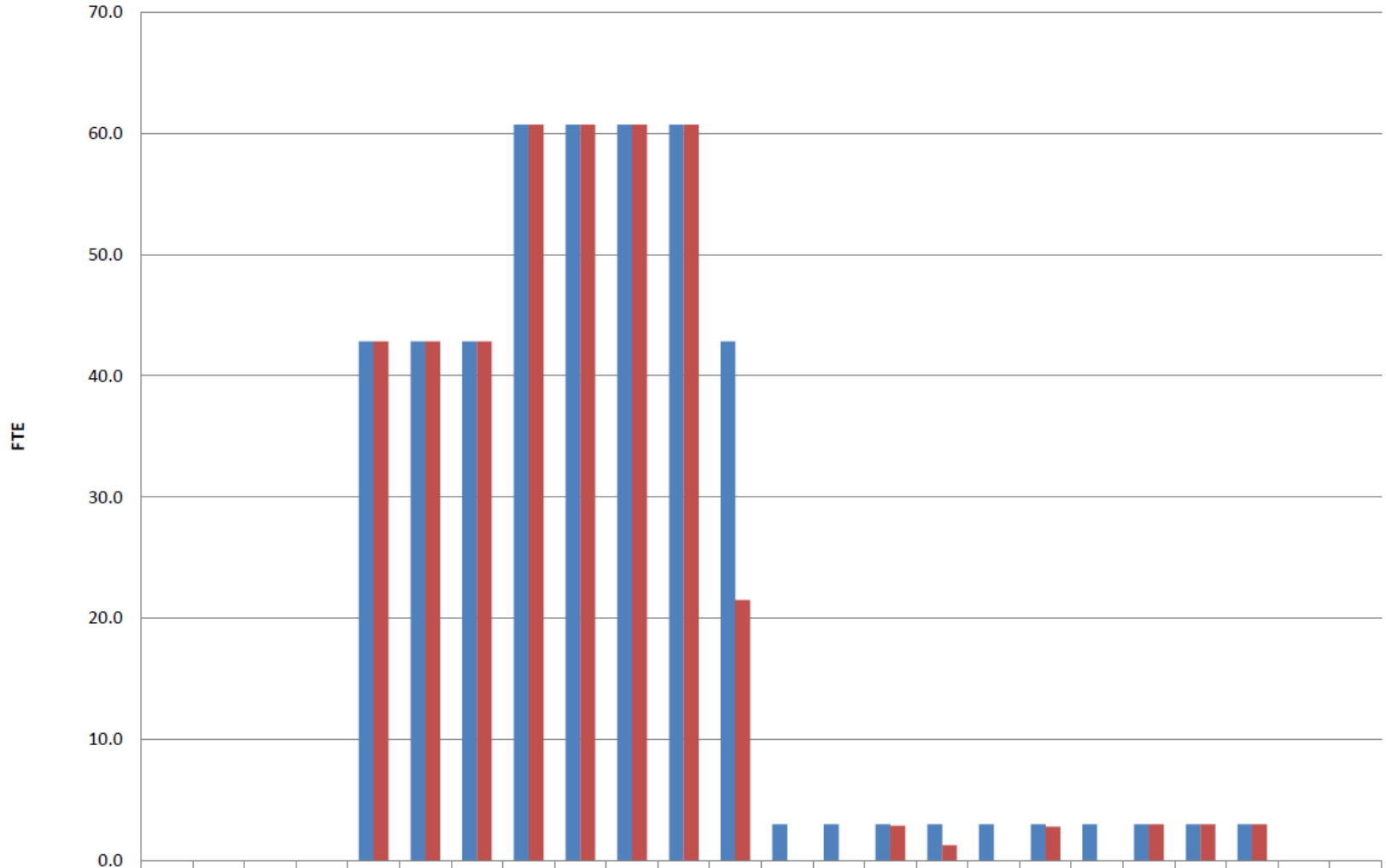
- Theoretical staffing plan for Lab Assistants
  - Staff hours: 444 hours (55.5 FTE)
  - Break/Lunch hours: 55.5 hours (7 FTE)
  - PTO/FMLA hours: 44 hours (5.5 FTE
  - Sick Leave/Other: 22 hours (3 FTE)
  - Total FTE hours per day: 565.5 hours (71 FTE)

Tue to Fri Accesioning Rate/Output



	0:00 to 1:00	1:00 to 2:00	2:00 to 3:00	3:00 to 4:00	4:00 to 5:00	5:00 to 6:00	6:00 to 7:00	7:00 to 8:00	8:00 to 9:00	9:00 to 10:00	10:00 to 11:00	11:00 to 12:00	12:00 to 13:00	13:00 to 14:00	14:00 to 15:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	18:00 to 19:00	19:00 to 20:00	20:00 to 21:00	21:00 to 22:00	22:00 to 23:00	23:00 to 24:00
Design Limit	0	0	0	0	3000	3000	3000	4250	4250	4250	4250	3000	210	210	210	210	210	210	210	210	210	210	0	0
Actual In-Handed	0	0	0	0	3000	3000	3000	4250	4250	4250	4250	1505	0	0	200	88	0	196	0	210	210	210	0	0

Tue to Fri IO Accessioning Staff



	0:00 to 1:00	1:00 to 2:00	2:00 to 3:00	3:00 to 4:00	4:00 to 5:00	5:00 to 6:00	6:00 to 7:00	7:00 to 8:00	8:00 to 9:00	9:00 to 10:00	10:00 to 11:00	11:00 to 12:00	12:00 to 13:00	13:00 to 14:00	14:00 to 15:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	18:00 to 19:00	19:00 to 20:00	20:00 to 21:00	21:00 to 22:00	22:00 to 23:00	23:00 to 24:00
Staff @ Bench	0.0	0.0	0.0	0.0	42.9	42.9	42.9	60.7	60.7	60.7	60.7	42.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.0	0.0
Work	0.0	0.0	0.0	0.0	42.9	42.9	42.9	60.7	60.7	60.7	60.7	21.5	0.0	0.0	2.9	1.3	0.0	2.8	0.0	3.0	3.0	3.0	0.0	0.0

Model Costs & Benefits

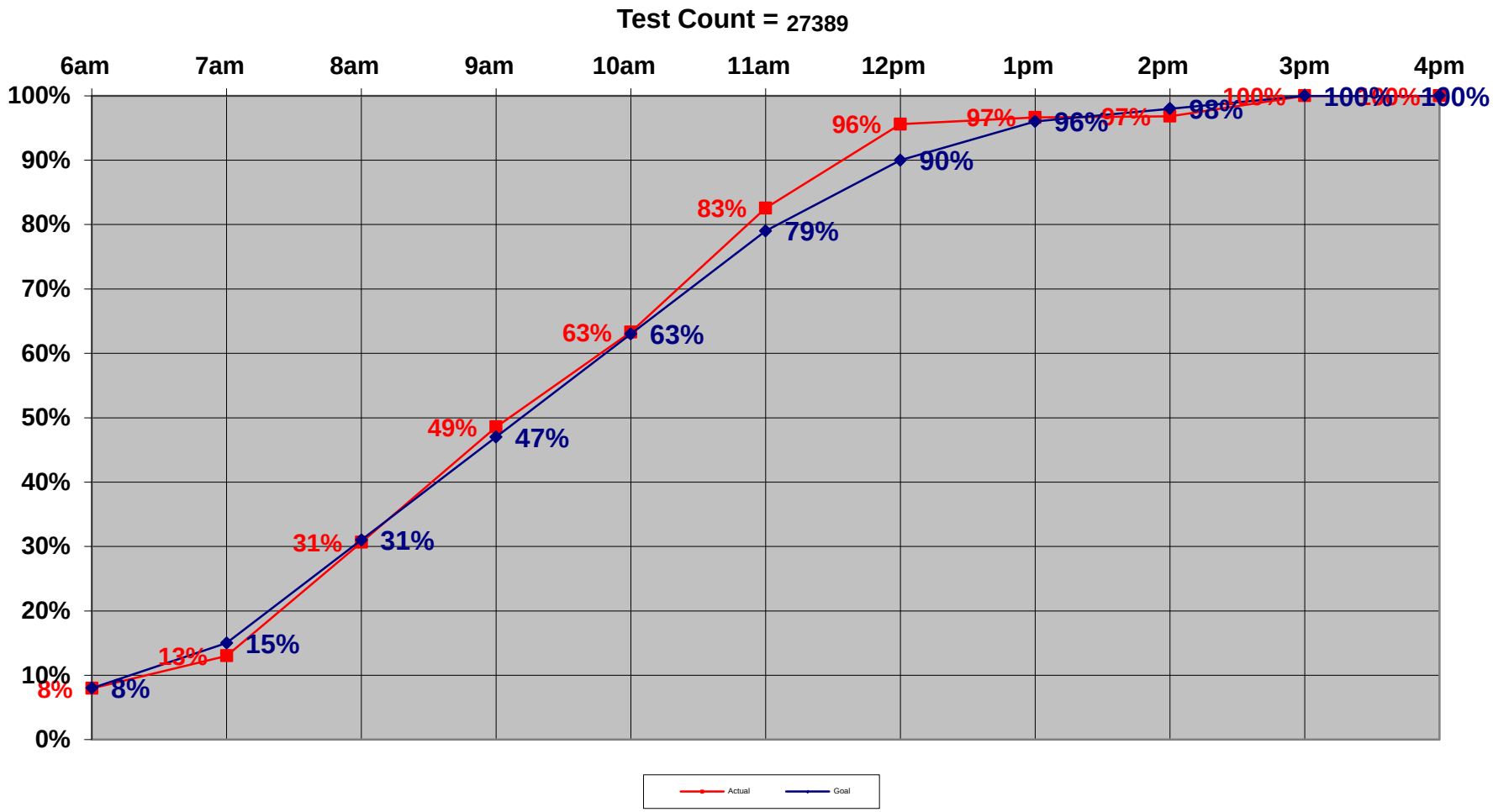
- Benefits
  - High personnel utilization, less FTE than 5am start
  - 20 FTE, 1 hr safety capacity at 11:00am
  - Achieves goal of minimizing tail

- Detractions
  - 4am start is difficult to recruit
  - Safety capacity too narrow a window
  - Insufficient flexibility for delays

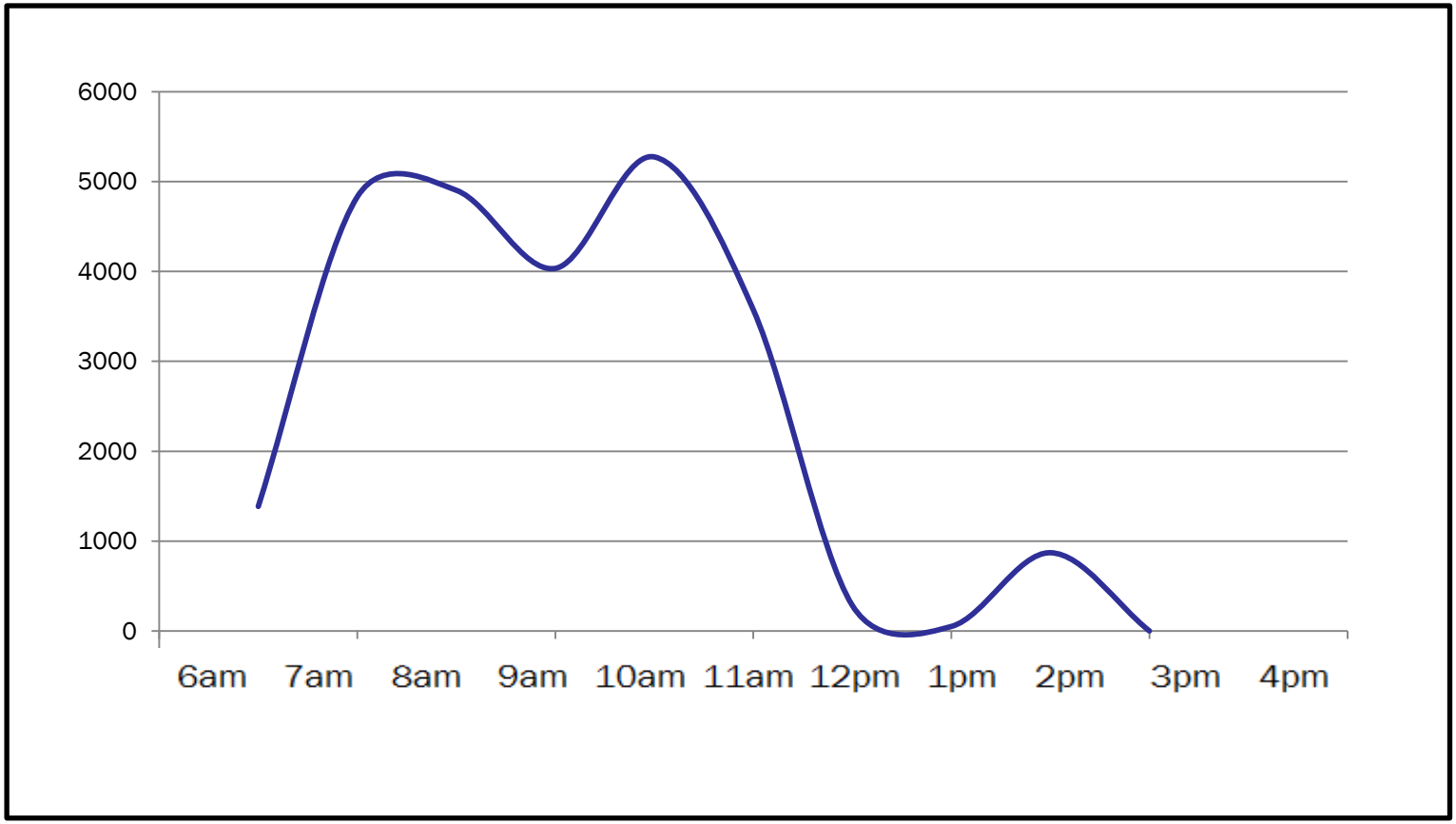
New Idea

- Remove restriction on floor space
- Allow

IO Productivity



Test count by hour charts 2016 dataset



Questions